Table S1. Genotypes used in this study, related to STAR Methods.

Figure	Male genotype
Figure 1A, B	w-, *10xUAS-IVS-Syn21-Chrimson::tdT3.1-SV40 (attp18)*, *13xLexAop2—Syn21-OpGCaMP6s-p10 (su(Hw)attp8)* ; *15A01-AD (attp40)*/+ ; *71G01-DBD (attp2)*/*Fru-LexA*
Figure 1C1-3	w-, *13xLexAop2-IVS-Syn21-mPA-p10 (su(Hw)attp8)* ; *15A01-AD (attp40)/13xLexAop2-IVS-Syn21-NLS-OpGCaMP6s-scalloped-NLS-p10 (su(Hw)attp5)* ; *71G01-DBD (attp2), 10xUAS-IVS-Syn21-Chrimson::tdT3.1-SV40 (su(Hw)attp1)/Fru-LexA*
Figure 1C4	w-, *13xLexAop2-IVS-Syn21-mPA-p10 (su(Hw)attp8)* ; *15A01-AD (attp40)/13xLexAop2-IVS-Syn21-NLS-OpGCaMP6s-scalloped-NLS-p10 (su(Hw)attp5)* ; *71G01-DBD (attp2), 10xUAS-IVS-Syn21-Chrimson::tdT3.1-SV40 (su(Hw)attp1)/41A01-LexA::p65 (attp2)*
Figure 1D	w- ; +/+ ; *41A01-Gal4 (attp2)/10xUAS-IVS-myr::GFP (attp2)*
Figure 1E	w-, *10xUAS-IVS-Syn21-Chrimson::tdT3.1-SV40 (attp18), 13xLexAop2—Syn21-OpGCaMP6s-p10 (su(Hw)attp8)* ; *15A01-AD (attp40)*/+ ; *71G01-DBD (attp2)/41A01-LexA::p65 (attp40, attp2, or VK00027)*
Figure 2B, F	w- ; *15A01-AD (attp40)/BDP-LexA::p65 (attp40)* ; *71G01-DBD (attp2), 10xUAS-IVS-Syn21-Chrimson::tdT3.1-SV40 (su(Hw)attp1)/13xLexAop2-IVS-Kir2.1::eGFP (VK00027)*
Figure 2C, G	w- ; *15A01-AD (attp40)/41A01-LexA::p65 (attp40)* ; *71G01-DBD (attp2), 10xUAS-IVS-Syn21-Chrimson::tdT3.1-SV40 (su(Hw)attp1)/13xLexAop2-IVS-Kir2.1::eGFP (VK00027)*
Figure 3B, E, H, K BDP>Chrimson	w- ; *BDP-AD (attp40)/20xUAS-IVS-Syn21-Chrimson::tdT3.1-SV40 (su(Hw)attp5)* ; *BDP-DBD (attp2)*/+
Figure 3B, E, H, K P1>Chrimson	w- ; *15A01-AD (attp40)/20xUAS-IVS-Syn21-Chrimson::tdT3.1-SV40 (su(Hw)attp5)* ; *15A01-DBD (attp2)*/+
Figure 3B, E, H, K pCd>Chrimson	w- ; *41A01-AD (attp40)/20xUAS-IVS-Syn21-Chrimson::tdT3.1-SV40 (su(Hw)attp5)* ; *21D06-DBD (attp2)*/+
Figure 4A-D pCd > GFP	w- ; *41A01-AD (attp4)*/+ ; *21D06-DBD (attp2)/10xUAS-IVS-syn21-GFP-p10 (attp2)*
Figure 4A-D pCd > Kir2.1	w- ; *41A01-AD (attp4)*/+ ; *21D06-DBD (attp2)/10xUAS-IVS-Kir2.1::eGFP (attp2)*
Figure 4A-D BDP > GFP	w- ; *BDP-AD (attp4)*/+ ; *BDP-DBD (attp2)/10xUAS-IVS-syn21-GFP-p10 (attp2)*
Figure 4A-D BDP > Kir2.1	w- ; *BDP-AD (attp4)*/+ ; *BDP-DBD (attp2)/10xUAS-IVS-Kir2.1::eGFP (attp2)*

Figure 5A	w- ; *20xUAS-Syn21-OpGCaMP6s-p10 (su(Hw)attp5)/41A01-AD (attp40) ; 10xUAS-IVS-Syn21-Chrimson::tdT3.1-SV40 (su(Hw)attp1)/21D06-DBD (attp2)*
Figure 5C, G1, G2, G4, G5	w-, *10xUAS-IVS-Syn21-Chrimson::tdT3.1-SV40 (attp18), 13xLexAop2—Syn21-OpGCaMP6s-p10 (su(Hw)attp8)* ; *15A01-AD (attp40)/13xLexAop2-IVS-GtACR1::eYFP-SV40 (attp40)* ; *71G01-DBD (attp2)/Fru-LexA*
Figure 5D, G3, G6	Same as Fig. 1A
Figure 6B	Canton S (+/+ ; +/+ ; +/+)
Figure 6D BDP>GtACR1	w- ; *BDP-AD (attp40)/+* ; *BDP-DBD (attp2)/ 20xUAS-IVS- GtACR1::eYFP-SV40 (attp2)*
Figure 6D pCd>GtACR1	w- ; *41A01-AD (attp40)/+* ; *21D06-DBD (attp2)/ 20xUAS-IVS- GtACR1::eYFP-SV40 (attp2)*
Figure 6D P1>GtACR1	w- ; *15A01-AD (attp40)/+* ; *71G01-DBD (attp2)/ 20xUAS-IVS- GtACR1::eYFP-SV40 (attp2)*
Figure 7C	w-, *10xUAS-IVS-Syn21-Chrimson::tdT3.1-SV40 (attp18), 13xLexAop2—Syn21-OpGCaMP6s-p10 (su(Hw)attp8)* ; *15A01-AD (attp40)/+* ; *71G01-DBD (attp2)/41A01-LexA::p65 (attp2, or VK00027)*
Figure S1	Same as Fig. 1A
Figure S2B left	Same as Fig. 1D
Figure S2B right	w- ; +/+ ; *21D06-Gal4 (attp2)/10xUAS-IVS-myr::GFP (attp2)*
Figure S2C left	Same as Fig. 1E
Figure S2C right	w-, *10xUAS-IVS-Syn21-Chrimson::tdT3.1-SV40 (attp18)*, *13xLexAop2—Syn21-OpGCaMP6s-p10 (su(Hw)attp8)* ; *15A01-AD (attp40)/+* ; *71G01-DBD (attp2)/21D06-LexA::p65 (attp2)*
Figure S2D	w- ; *41A01-AD (attp40)/+* ; *21D06-DBD (attp2)/10xUAS-IVS-myr::GFP (attp2)*
Figure S2E left	w- ; *10xUAS-IVS-NLS-tdTomato (VK00022)/+* ; *41A01-LexA::p65 (VK00027), 13xLexAop2-IVS-NLS-GFP (VK00040)/41A01-Gal4 (attp2)*
Figure S2E middle	w- ; *10xUAS-IVS-NLS-tdTomato (VK00022)/+* ; *41A01-LexA::p65 (VK00027), 13xLexAop2-IVS-NLS-GFP (VK00040)/21D06-Gal4 (attp2)*
Figure S2E right	w- ; *10xUAS-IVS-NLS-tdTomato (VK00022)/41A01-AD (attp40)* ; *41A01-LexA::p65 (VK00027), 13xLexAop2-IVS-NLS-GFP (VK00040)/21D06-DBD (attp2)*
Figure S2F	w-,*10xUAS-IVS-myr::GFP (su(Hw)attp8)* ; *41A01-AD (attp40)/+* ; *Chat-DBD/+*
Figure S2G	w-,*10xUAS-IVS-myr::GFP (su(Hw)attp8)* ; *Gad1-AD/+* ; *41A01-DBD (attp2)/+*
Figure S2H	w-,*10xUAS-IVS-myr::GFP (su(Hw)attp8)* ; *41A01-AD (attp40)/+* ; *VGlut-DBD/+*
Figure S2I	w-,*10xUAS-IVS-myr::GFP (su(Hw)attp8)* ; *41A01-AD (attp40)/+* ; *Dsx-DBD/+*
Figure S3	Same as Fig. 1E

Figure S4A-C	w- ; *15A01-AD (attp40)*/+ ; *71G01-DBD (attp2)/UAS-Denmark, UAS-Syt-eGFP*
Figure S4D-F	w- ; *41A01-AD (attp40)*/+ ; *21D06-DBD (attp2)/UAS-Denmark, UAS-Syt-eGFP*
Figure S4J-I	w-, *13xLexAop2-IVS-myr::tdTomato (attp18)* ; *41A01-LexA (attp40)/LexAop-CD4::spGFP11* ; *71G01-Gal4 (attp2)/UAS-CD4::spGFP1-10*
Figure S4M-O	w-, *13xLexAop2-IVS-myr::tdTomato (attp18)* ; *41A01-LexA (attp40)/LexAop-CD4::spGFP11* ; *15A01-Gal4 (attp2)/UAS-CD4::spGFP1-10*
Figure S4P-R	w-, *13xLexAop2-IVS-myr::tdTomato (attp18)* ; *GH146-Gal4/LexAop-CD4::spGFP11* ; *Or83b-LexA/UAS-CD4::spGFP1-10*
Figure S5A	w- ; *BDP-AD (attp40)/13xLexAop2-IVS-CsChrimson::mVenus (attp40)* ; *BDP-DBD (attp2)/15A01-LexA::p65 (attp2), UAS-Kir2.1::eGFP*
Figure S5B	w- ; *41A01-AD (attp40)/13xLexAop2-IVS-CsChrimson::mVenus (attp40)* ; *21D06-DBD (attp2)/15A01-LexA::p65 (attp2), UAS-Kir2.1::eGFP*
Figure S6A, B	Same as Fig. 5C
Figure S6C-E	w-, *10xUAS-IVS-Syn21-Chrimson::tdT3.1-SV40 (attp18), 13xLexAop2—Syn21-OpGCaMP6s-p10 (su(Hw)attp8)* ; *15A01-AD (attp40)/13xLexAop2-IVS-GtACR1::eYFP-SV40 (attp40)* ; *71G01-DBD (attp2)/41A01-LexA (attp2 or VK00027)*
Figure S7	Same as Fig. 6D

Insertion sites: attp18 (X), su(Hw)attp8 (X), su(Hw)attp5 (2R), VK00022 (2R), attp40 (2L), VK00040 (3R), VK00027 (3R), su(Hw)attp1 (3R), attp2 (3L).

Females: always wild-type Canton S (+/+ ; +/+ ; +/+)

Table S2. Statistics, related to STAR Methods.

Figure	Statistical test	Comparisons	Identifiers	p-values
Figure 1C2	Mann-Whitney U-test	NLS vs Cyto. GCaMP	n.s	0.15
Figure 2D left	Mann-Whitney U-test	BDP vs pCd	****	9.5e-13
Figure 2D right	Mann-Whitney U-test	BDP vs pCd	n.s	0.82
Figure 2H left	Mann-Whitney U-test	BDP vs pCd	****	3.6e-16
Figure 2H right	Mann-Whitney U-test	BDP vs pCd	n.s	0.11
Figure 3C during photo-stimulation	Kruskal-Wallis test Dunn's correction	BDP vs pCd BDP vs P1	n.a ****	not applicable 2.5e-13
Figure 3C after photo-stimulation	Kruskal-Wallis test Dunn's correction	BDP vs pCd BDP vs P1	n.a ****	not applicable 4.4e-13
Figure 3F during photo-stimulation	Kruskal-Wallis test Dunn's correction	BDP vs pCd BDP vs P1	**** ****	6.6e-06 1.5e-07
Figure 3F after photo-stimulation	Kruskal-Wallis test Dunn's correction	BDP vs pCd BDP vs P1	**** ****	2.5e-06 6.4e-09
Figure 3I after photo-stimulation	Kruskal-Wallis test Dunn's correction	BDP vs pCd BDP vs P1	n.s ****	0.58 1.3e-11
Figure 3L after photo-stimulation	Kruskal-Wallis test Dunn's correction	BDP vs pCd BDP vs P1	**** ****	3.0e-08 7.9e-08
Figure 4B pCd	Mann-Whitney U-test	pCd>GFP vs pCd>Kir2.1	****	9.9e-07
Figure 4B BDP	Mann-Whitney U-test	BDP>GFP vs BDP>Kir2.1	n.s	0.4036
Figure 4C left total	Mann-Whitney U-test	pCd>GFP vs pCd>Kir2.1	**	0.0017
Figure 4C left first 20%	Mann-Whitney U-test	pCd>GFP vs pCd>Kir2.1	n.s	0.46
Figure 4C left last 20%	Mann-Whitney U-test	pCd>GFP vs pCd>Kir2.1	****	6.7e-06
Figure 4C right total	Mann-Whitney U-test	BDP>GFP vs BDP>Kir2.1	n.s	0.38

Figure 4C right first 20%	Mann-Whitney U-test	BDP>GFP vs BDP>Kir2.1	n.s	0.18
Figure 4C right last 20%	Mann-Whitney U-test	BDP>GFP vs BDP>Kir2.1	n.s	0.30
Figure 4D left total	Mann-Whitney U-test	pCd>GFP vs pCd>Kir2.1	****	6.4e-09
Figure 4D left first 20%	Mann-Whitney U-test	pCd>GFP vs pCd>Kir2.1	n.s	0.26
Figure 4D left last 20%	Mann-Whitney U-test	pCd>GFP vs pCd>Kir2.1	****	3.6e-07
Figure 4D right total	Mann-Whitney U-test	BDP>GFP vs BDP>Kir2.1	n.s	0.56
Figure 4D right first 20%	Mann-Whitney U-test	BDP>GFP vs BDP>Kir2.1	n.s	0.74
Figure 4D right last 20%	Mann-Whitney U-test	BDP>GFP vs BDP>Kir2.1	n.s	0.79
Figure 5H pCd	Mann-Whitney U-test	Light on vs Light off	****	6.1e-06
Figure 5H PPF2	Mann-Whitney U-test	Light on vs Light off	n.s	0.87
Figure 6D within genotype	Wilcoxon signed-rank test	BDP>GtACR1 pCd>GtACR1 P1>GtACR1	n.s **** n.s	0.80 6.79e-06 0.49
Figure 6D between genotype	Kruskal-Wallis test Dunn's correction	BDP vs pCd BDP vs P1	** n.s	0.0070 1
Figure 6D	Wilcoxon signed-rank test	cVA only vs P1+cVA	**	0.0020
Figure S1H	Mann-Whitney U-test	P1 vs PPF1	****	6.2e-18
Figure S3B	Wilcoxon signed-rank test Dunn's correction	1^{st} vs 2^{nd} 2^{nd} vs 3^{rd}	* n.s	0.011 0.15
Figure S3D	Wilcoxon signed-rank test Dunn's correction	1^{st} vs 2^{nd} 2^{nd} vs 3^{rd}	* n.s	0.011 0.65
Figure S3F	Wilcoxon signed-rank test Dunn's correction	1^{st} vs 2^{nd} 2^{nd} vs 3^{rd}	n.s n.s	1 0.65
Figure S5C during photo-stimulation	Mann-Whitney U-test	BDP vs pCd	n.s	0.56

Figure S5C after photo-stimulation	Mann-Whitney U-test	BDP vs pCd	****	2.4e-06
Figure S5D during photo-stimulation	Mann-Whitney U-test	BDP vs pCd	n.s	0.37
Figure S5D after photo-stimulation	Mann-Whitney U-test	BDP vs pCd	****	2.8e-09
Figure S8C	Mann-Whitney U-test	Light on vs Light off	**	0.0091